Sailboats on Willamette Valley lake

Chapter 12 Post-War Multi-Purpose Development of the Willamette

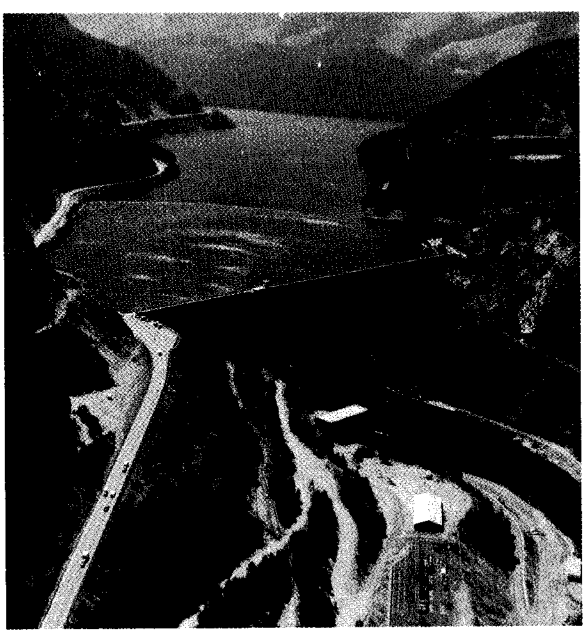
Willamette River Basin Projects

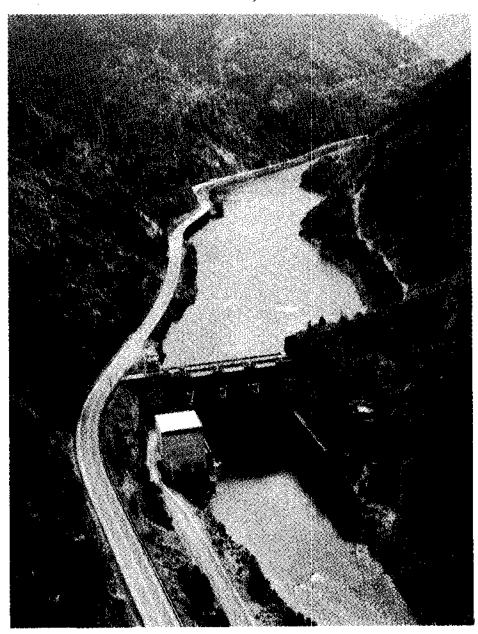
The Portland District continued to emphasize the flood control component of multiple-purpose development of the Willamette River Basin after World War II. During this period, the Flood Control Acts of 1950 and 1962 enlarged upon the basic plan authorized in the 1938 Flood Control Act. Under the 1938 act, the Corps initiated the first three reservoirs in the Willamette Basin—Fern Ridge, Cottage Grove, and Dorena—before the Second World War. Two others authorized in the 1938 act, Sweet Home and Quartz Creek, were not built. The Corps never constructed Sweet Home because engineers discovered a more effective site on the same stream; environmental and fishery concerns prevented undertaking Quartz Creek. The district started two other projects authorized in 1938 immediately after World War II and subsequently completed several others under the Flood Control Acts of 1950 and 1962. In all, Congress authorized the Corps of Engineers to construct 17 projects in the Willamette Basin, 14 multiple-purpose structures and three reregulating dams. To date, the Portland District has completed eleven storage and two reregulating projects. Major Floods in December 1964 and January 1965 tested the value of the completed Projects.

In 1947, the Portland District started two projects listed in the 1938 Flood Control Act, Detroit Dam and Lookout Point. The district completed Detroit Dam on the North Santiam River first. Detroit required a reregulating dam to smooth out destructive fluctations in the downstream flow and level of the river caused by sudden storage releases for electric generation peaking operations. The reregulation dam, Big Cliff, also generated a small amount of continuous power.

Detroit, a concrete gravity dam, contains a total storage capacity of 455,000 acre-feet and usable flood control storage of 300,000 acre-feet. The difference between these two figures—155,000 acre-feet—is inactive or dead storage, reservoir water not released because it must be retained for power generation. The 1,580-foot long, 360-foot high Detroit Dam holds two generating units with a total capacity of 100,000 kilowatts. Big Cliff has one unit of 18,000 kilowatts. Detroit's 9-mile long reservoir controls runoff from an area of 438 square miles and has a full-pool area of 3,580 acres. By comparison, Big Cliff Dam is 280 feet long, 191 feet high, and has a pool area of 100 acres. Located 43 miles east of Salem on the west slope of the Cascade Range, Detroit and Big Cliff dams cost $63 million when completed in 1953. Since beginning operation, this project has prevented an estimated $238 million in flood damages.[1]

Lookout Point Dam, the last project completed by the Portland District under the 1938 Flood Control Act, is located on the Middle Fork Willamette River, 20 miles southeast



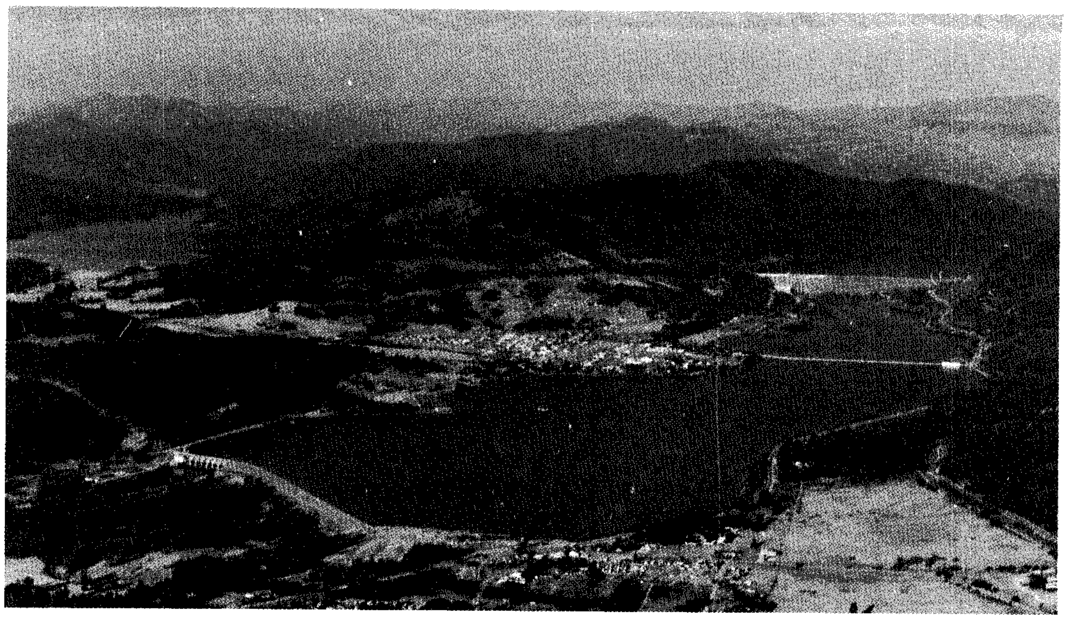


right: Detroit Dam
far right: Big Cliff Dam

of Eugene. Dexter Dam, 2.8 miles downstream, reregulates releases from Lookout Point and provides 27,500 acre-feet of storage. Begun in 1947, Lookout Point Reservoir has a total storage capacity of 456,000 acre-feet and controls run-off from an area 991 square miles. The 135,000 kilowatts of power produced by Lookout Point and its reregulating dam is slightly over 25 percent of the generating capacity of the original Bonneville Dam units. The 270-foot-high 3,381-foot-long embankment structure contains a 274-foot-long concrete spillway with 5 gates. The 4,360-acre reservoir is 14.2 miles long.

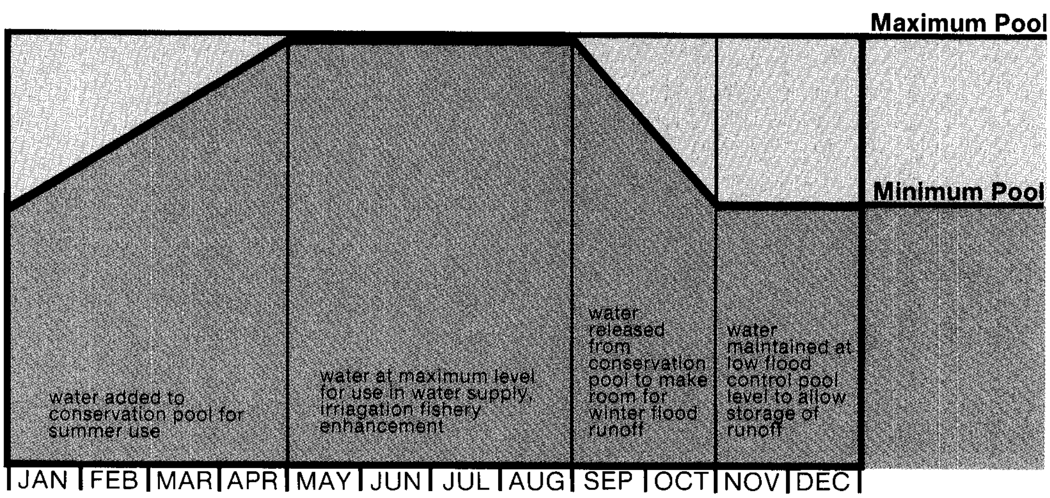
Because of its strategic location at the upper end of the Willamette Valley, Lookout Point Dam plays a key role in the Willamette Basin multiple-purpose storage program. Starting in late August or early September, Corps' personnel lower the pool until the total flood control space of 337,000 acre-feet is available. Controlled releases from the reservoir aid electric power generation, downstream navigation, and irrigation. Incidental benefits accrue to fishing, recreation, and pollution control. By November 15 the pool is down to its minimum flood control stage, about 100 feet below summer pool levels. Except as flood waters add to this pool, it is maintained at minimum levels through the winter months. The operators release flood waters immediately after high water periods. The pool begins filling again on February 1 and reaches its maximum height by about May 10. High pool levels during summer months allow recreational use of the lake. The Portland District completed Lookout Point and Dexter Dams in 1954 at a cost of $88 million and estimated that through 1978 they have prevented $315 million in flood damages.[2]

The Portland District's post-war review of the 308 report also included significant revisions of its Willamette River Basin Project. The revised plan called for 15 reservoirs in



Lookout Point and Dexter Dams

Seasonal Reservoir Storage for Flood Control

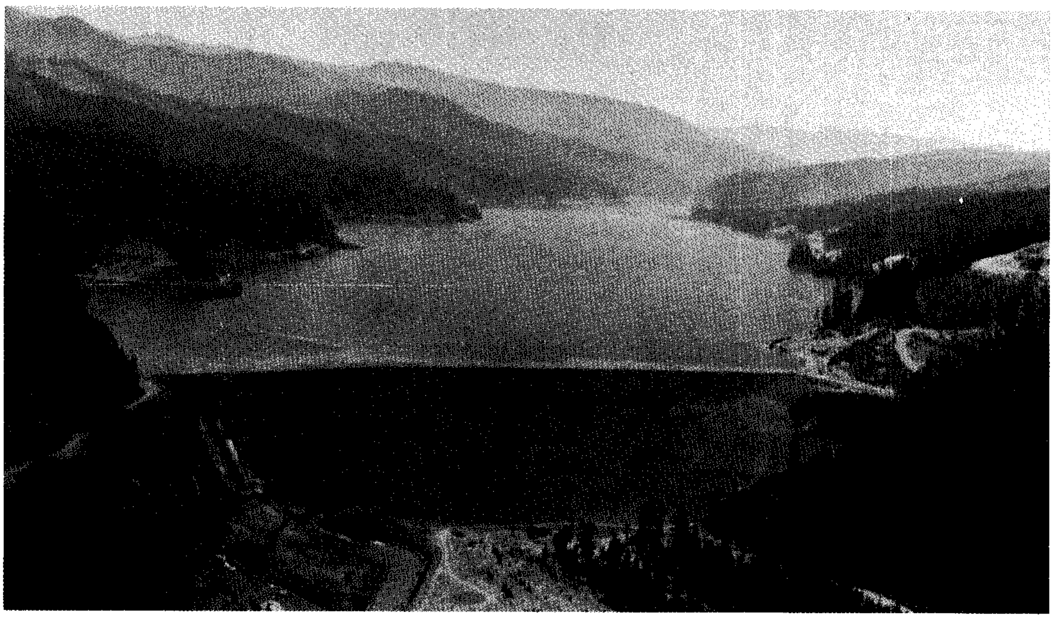


Willamette Valley flood control projects operate following a reservoir regulation rule curve similar to that at right.

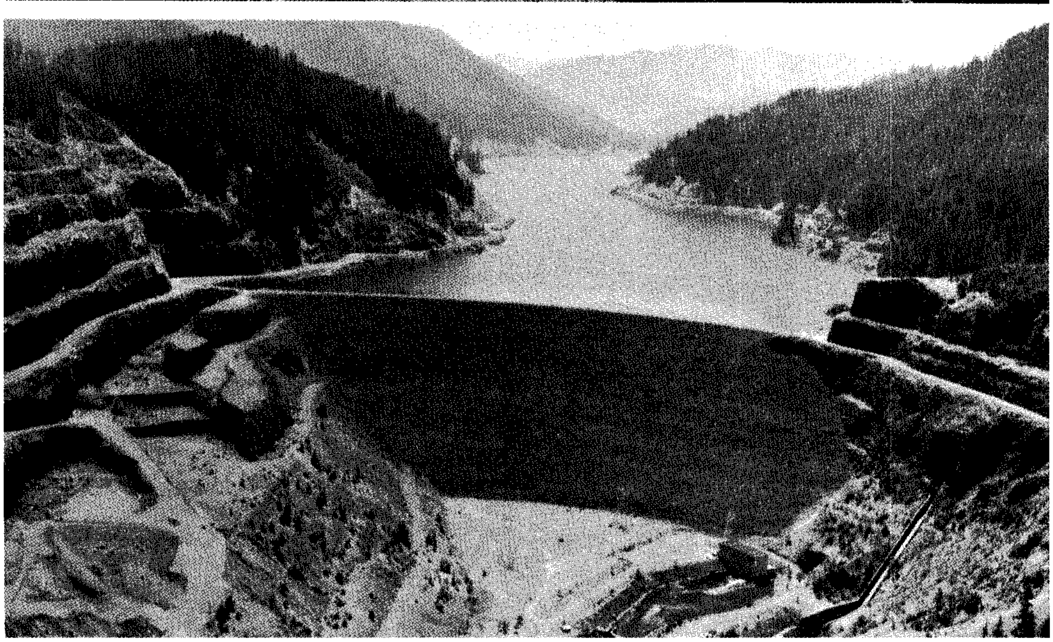
addition to the 5 already built or under construction. These 20 reservoirs would have 2.5 million acre-feet of multiple-purpose storage. The study also recommended 87.4 miles of supplemental levees along the Willamette, 722 miles of channel improvements on the Willamette and tributaries, use of 640,000 acre-feet of stored water for irrigation, and power facilities for generating 387,00 killowatts at eight of the reservoirs. Through the revised plan, the Corps proposed to reduce annual flood damage by 88 percent, improve field drainage, aid navigation on the Willamette, irrigate 452,100 acres of land, generate significant amounts of power, and reduce downstream pollution. In the Flood Control Act of 1950, Congress authorized several of the proposed projects. The Corps completed two of these projects, Hills Creek Reservoir and Cougar Dam, by the mid-1960s.[3]

Located 26 miles upstream from Lookout Point Dam, Hills Creek Reservoir sits at the confluence of the Middle Fork Willamette River and Hills Creek. It has 356,000 acre-feet of total storage and two 15,000-kilowatt generating units. Construction of Hills Creek Reservoir started in 1956, and the Portland District completed the 2,150-foot-long, 340-foot-high earth and gravel fill dam in 1961. The reservoir extends eight miles up the Middle Fork Willamette River and about three miles up Hills Creek and operates as a unit with Lookout Point Dam downstream. It controls runoff from a 389-square-mile area. The project cost $46 million and has prevented an estimated $187 million in flood damage.[4]

Work on Cougar Dam on the South Fork McKenzie River started in 1956 and reached completion in 1964. The highest embankment dam ever built by the Corps, Cougar reaches 452 feet above the streambed. The dam is one of the three headwater tributary projects built in lieu of the Quartz Creek project, which had been authorized in 1938. A



Hills Creek Dam



Cougar Dam

multiple-purpose dam, Cougar has two 12,500-kilowatt generating units which went into service in 1964. During construction, engineers discovered an ancient river channel beneath the dam site, which required extensive excavation and embankment work to seal off. Cougar Dam has a 1,280-acre reservoir with storage amounting to 219,000 acre-feet. Total cost of the project came to $57 million, with an estimated flood prevention benefit of $91 million.[5]

Flood Control Efforts

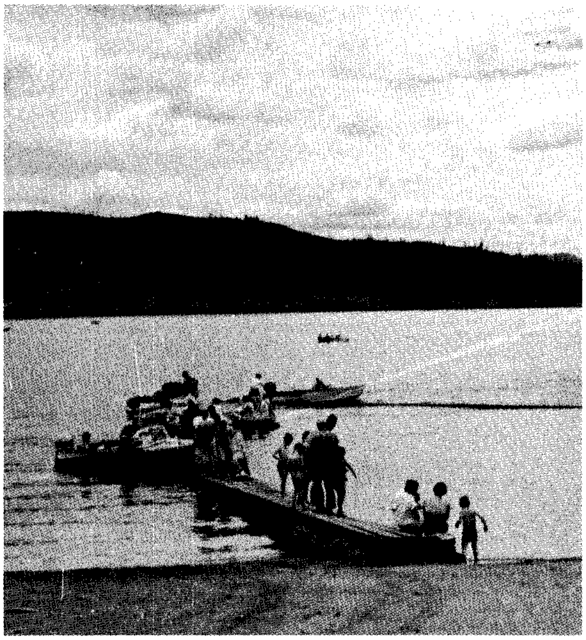
In the late 1950s, the Portland District once again reevaluated the Willamette River Basin projects. To asses the damage prevention abilities of the projects in operation, the Corps examined the impact of the December 1955 flood. This flood had a recurrence rate of once in 20 years. The study indicated that existing flood control works prevented damages of $13.6 million at that time. However, unless the Congress authorized additional flood control projects, the Willamette Valley would continue suffering average annual flood losses of $7.1 million based on 1957 prices and forecasted 1985 development. The report also found a need for more electric power, improved navigation, increased irrigation, expanded recreation facilities, added fish enhancement, and water pollution abatement as a result of changed conditions in the basin.

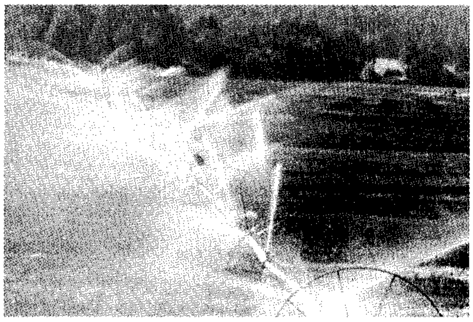
To reduce average annual flood damage and provide the other multiple-purpose benefits, the Corps recommended five new projects. The Portland District wanted to build Cascadia and Foster Reservoirs on the South Santiam River, Strube Reregulating Dam and Gate Creek Reservoir on the McKenzie River Basin, and to modify the older Fern Ridge Dam on the Long Tom River. Congress authorized these projects in the Flood Control Act of 1962 but funded only the Foster Reservoir and modifications to Fern Ridge.[6]

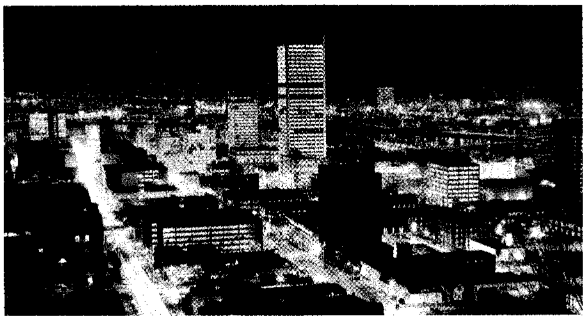
A major test of the flood control abilities of the Willamette Basin projects came in the winter of 1964-65. At that time severe flooding hit the Northwest, especially in western Oregon. While floods struck hardest in the Willamette Basin, great damage also occurred in the lower Columbia, Rogue River, Umpqua, and Coquille River Basins; on other coastal streams; and throughout the Great Basin on the east side of the Cascade Mountains in Oregon and nothern California.[7]

Extreme weather conditions caused the flooding of 1964-65. These included general and heavy rainfall which left the ground saturated; low or record low temperatures which froze the ground; heavy, wet snowfall; and heavy precipitation and sudden warming which melted snowpack up to an elevation of 10,000 feet in the mountainous watersheds. Such

right: Recreation on Willamette Valley lake, far right: Water for agricultural irrigation, below right: Electrical demands of Oregon cities are partially met with power produced by Willamette reservoirs.







Willamette Valley lakes help prevent extensive flooding like that of 1894, 1948 and 1964.

conditions frequently produced winter floods in the Willamette Basin. The flood of 1861 was the greatest, but other noteworthy basin-wide floods took place in 1890, 1923, 1945, and 1955. Without upstream storage regulation, the 1964 flood would have been comparable to the flood of 1861.

In December 1964, most unregulated tributaries of the Willamette experienced floods of a magnitude expected to occur once in 100 years. Every stream tributary to the Willamette reached major flood stage. Several locations on the Willamette River below major tributaries experienced 100-year floods. Except in the Eugene area, which greatly benefitted from regulation by upstream storage reservoirs, water exceeded flood stages on the main Willamette River by as much as eight feet. At Eugene, Albany, and Salem, the number of days during which high waters remained above bankfull stages surpassed similar periods of all floods in the twentieth century. In most instances, the Willamette River and its tributaries produced peak discharges, some exceeding the previous record by as much as 50 percent.

As a result of record flooding on all streams of the Willamette Basin, $71 million of the $148 million in damages suffered in the Portland District occurred in the Willamette Valley. Agricultural losses were the heaviest, with about 215,00 acres inundated at a loss of over $16 million. Vast areas experienced serious erosion or lost topsoil, livestock perished, and river banks crumbled away in many locations. Debris consisting of logs, trees, brush, and destroyed property clogged waterways. The high water devastated orchards in many areas, and either washed out or silted under valuable fields of berries and vegetables.

Transportation, industrial, residential, and commercial losses followed closely behind agriculture. The community of North Albany was evacuated and incurred serious industrial losses. High water up to nine feet deep flooded 300 houses in the north section of Salem. The flood destroyed the Salem municipal sewage plant, spreading pollutants over a wide area. The disrupted sewage service caused damage to downtown Salem. Local authorities evacuated Salem Memorial Hospital, as well as many residences, commercial establishments, and offices.

Simultaneous flooding on the Columbia and Willamette rivers caused considerable damage in the Portland area, as the city experienced its highest winter stages in history. While the Willamette River reached record or near record levels, the stretch of the Columbia River from Bonneville Dam to its mouth experienced its largest winter flood ever. The same combination of saturated ground conditions, freezing snowfall, and heavy, warm rainfall produced floods on the lower Columbia River as on the Willamette. If there had been no upstream storage, the December 1964 flood would have been the second largest flood of record for the lower Columbia, exceeding even the June 1948 flood. The unusual combination of winter high water on both the Willamette and lower Columbia extensively damaged transportation facilities along the Columbia, causing over $7 million in washed out highways and bridges, and destroying railroad track and rolling stock. The town of Rufus, near the incomplete John Day Dam, suffered severe damages. Total losses on the lower Columbia and tributaries came to $20 million.

The rampaging water almost completely submerged Willamette Falls at Oregon City and inundated major paper plants on both banks of the falls. The ensuing damage ran into

The 1964 floodwaters breach downtown Portland's seawall.

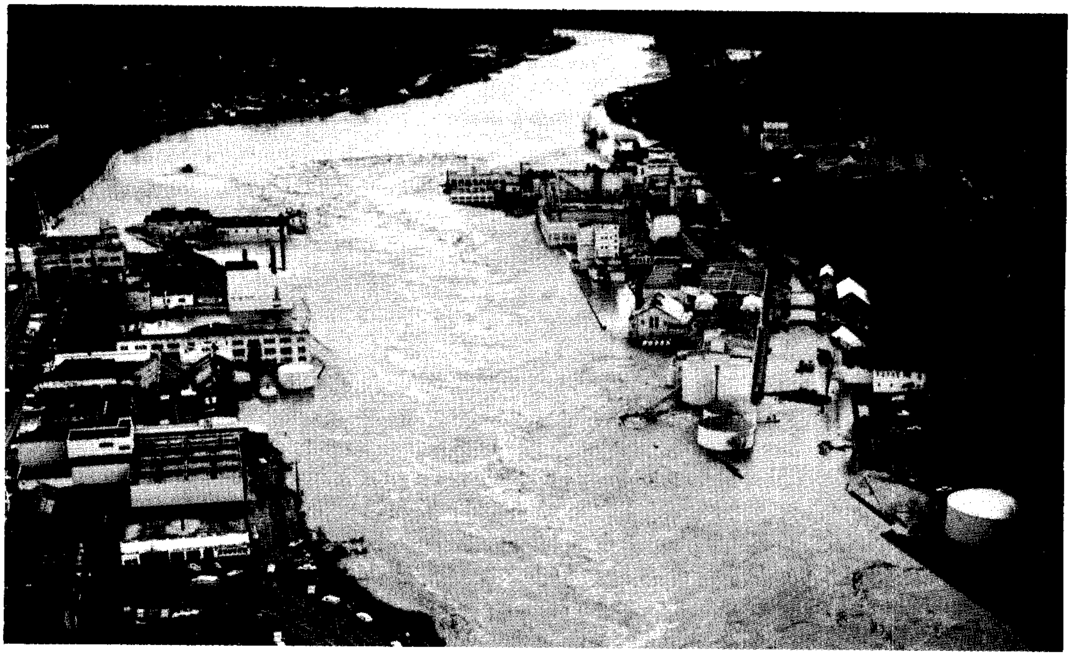
Portland docks and railroad yards inundated.

Highway washed out by 1964 floodwater.

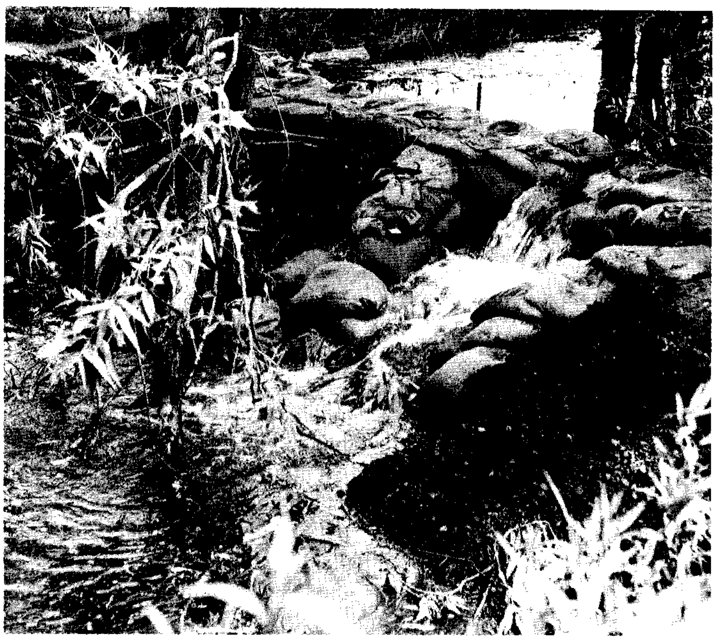
House carried downstream by rapidly moving floodwater.

the millions of dollars. A major shopping center in Oregon City came under several feet of water and disposal of contaminated foodstuffs and other items became a large problem. Residential losses along the lower Willamette were high. Industries between the Sellwood and Hawthorne Bridges in Portland had heavy losses, and many warehouse and manufacturing plants on the city's lower east side underwent flooding. The flood weakened and damaged wharf and dock facilities, and debris made ship movement in the harbor dangerous. In all, the debris, drift, and trash jams on the basin's rivers constituted one of the most troublesome aspects of the flood.

In the Rogue River Basin in southern Oregon, 13 of 16 gauging stations reported record highs in peak discharge or flood state. Complete records became impossible because


Willamette Falls at Oregon City completely inundated by high water.


Vast areas of farmland underwater.


Break in sandbag levee.

some of the measuring gauges simply washed away. Along one stretch of the Rogue, surging water destroyed or heavily damaged 250 homes and 30 commericial establishments. The flood took out or greatly damaged every bridge across the river. Eight feet of water covered the finest residential section of Grants Pass, Oregon. Considerable damage occurred at residential, commercial, and marine facilities located in Gold Beach, at the mouth of the Rogue. Total losses in the basin exceeded $25 million.

Runoff on the Umpqua River exceeded previous record levels at 14 of 24 stations. Damages reached $29 million, mainly in the central valley and at Reedsport at the mouth of the Umpqua River. The flood-waters at Reedsport overtopped the levee and poured eight feet of debris-laden water over most of the town. In Roseburg, a junior high school and a convalescent home were among the many victims of the flood. High water submerged 250 homes and destroyed many outbuildings such as barns, sheds, and garages. Flood water covered three miles of Interstate Highway 5 near Myrtle Creek. The Umqua drainage also had heavy agriculture, log, and lumber losses.

Five of six measuring stations on the Coquille River exceeded previously recorded stages. Agriculture suffered half of the $3 million damages in the Coquille River Basin and industry about one quarter. Finally, near-record flows on inland streams in the Great Basin and on coastal streams in addition to those discussed caused about $11.5 million damage, principally to agriculture.

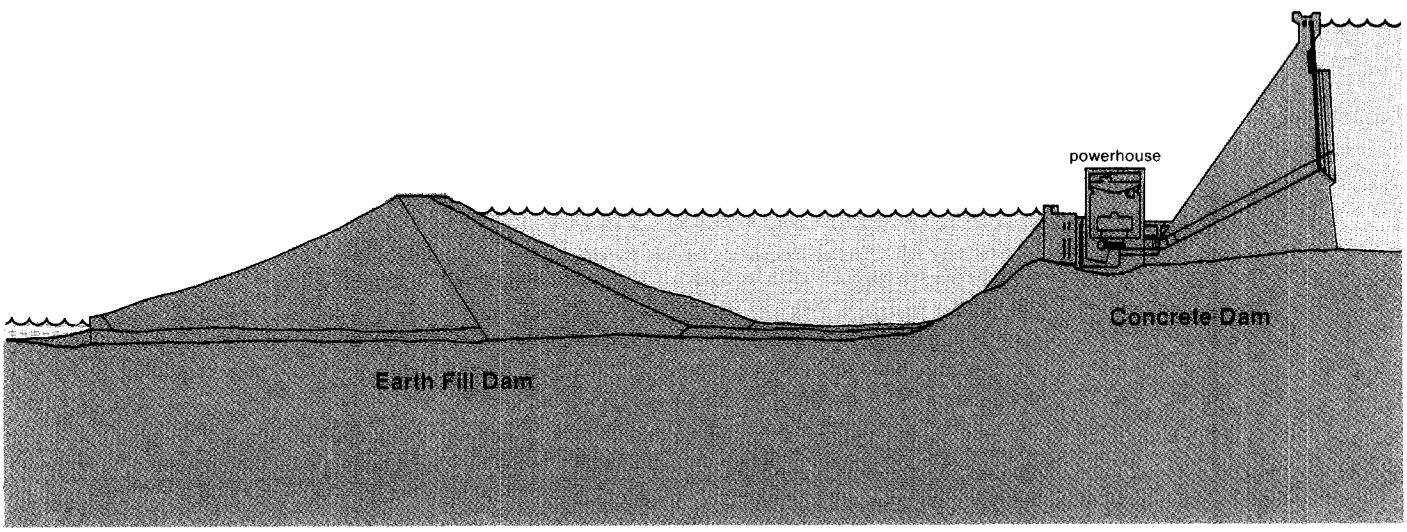
Federal statutes delegated authority to the district engineer to perform flood-fighting and rescue operations. When river stages reach a predetermined level, an emergency operations plan goes into effect. Ordinarily, Corps' flood-fight efforts only supplement the work of other agencies; however, if local authorities are unable to cope with the situation and request aid, the Corps may undertake direct supervision of emergency operations. These flood-fight activities come under the direction of the District Control and Disaster Operations Centers. As in the Columbia River flood of 1948, district employees played a significant role in the 1964 flood-emergency operation. On 22 December, district and project offices dispatched over 212 employees to assist in inspection, construction, control, and maintenance of permanent and temporary flood control projects. The district gave considerable assistance to state and local agencies. The total cost of federal emergency flood-fighting activities came to $315,145, with most of it spent in the Willamette River Basin. The Portland District expended $3.9 million on post-flood recovery work throughout the entire district.

Existing Corps of Engineers flood control projects prevented $514 million in damages in the Willamette Valley during the floods of 1964-65. Seven storage reservoirs accounted for nearly all of this prevention, with bank protection, levees, and channel improvements responsible for about $4 million. If the 1964-65 floods had been unregulated by storage, flooded agricultural areas would have doubled to 500,000 acres. Willamette Basin storage reservoirs decreased flood stages at Eugene from 39 to 24.2 feet. The flood control projects reduced stages at Salem by 7.5 feet, by 3 feet at Oregon City, and by 4.5 feet at Portland. These stage reductions prevented extensive damages to residential and mill properties in the Eugene-Springfield area, the thorough inundation of downtown Salem, and greater destruction of low-lying industrial development in Oregon City.

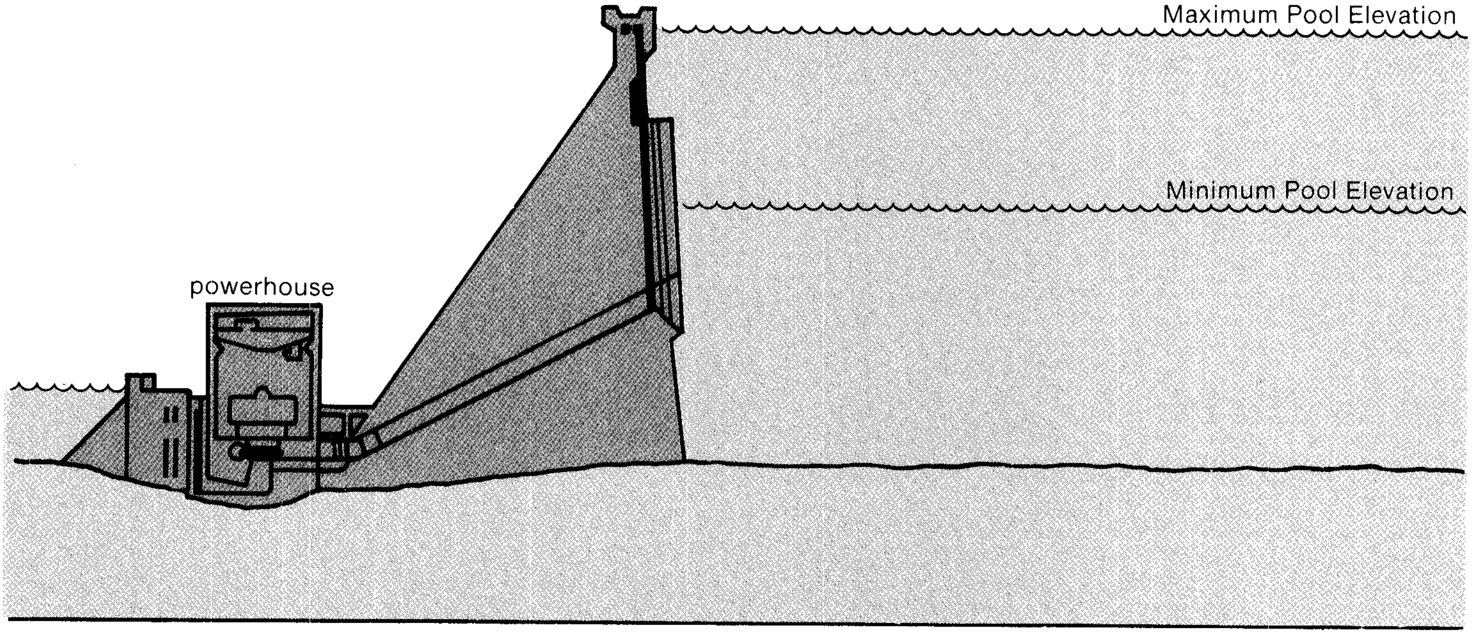
Portland harbor would have been completely clogged with logs and debris. Moving at high flood velocities, debris and logs probably would have destroyed every bridge crossing on the Willamette River except the St. Johns. Damage to moored vessels would have been tremendous. Even with the regulation provided by storage, officials closed some of the bridges at the peak of the flood because of danger of sudden collapse. Railroad switching yards, terminals, and track as well as highway terminals, harbor docks, and associated facilities would have suffered extreme damage. Such destruction would have crippled the freight transportation facilities of the commerical hub serving half of the Pacific Northwest.

Under natural conditions, the 1964 flood would have exceeded the record stages of the 1894 Columbia River flood by one foot at Portland, bringing the level to 34.4 feet. Water

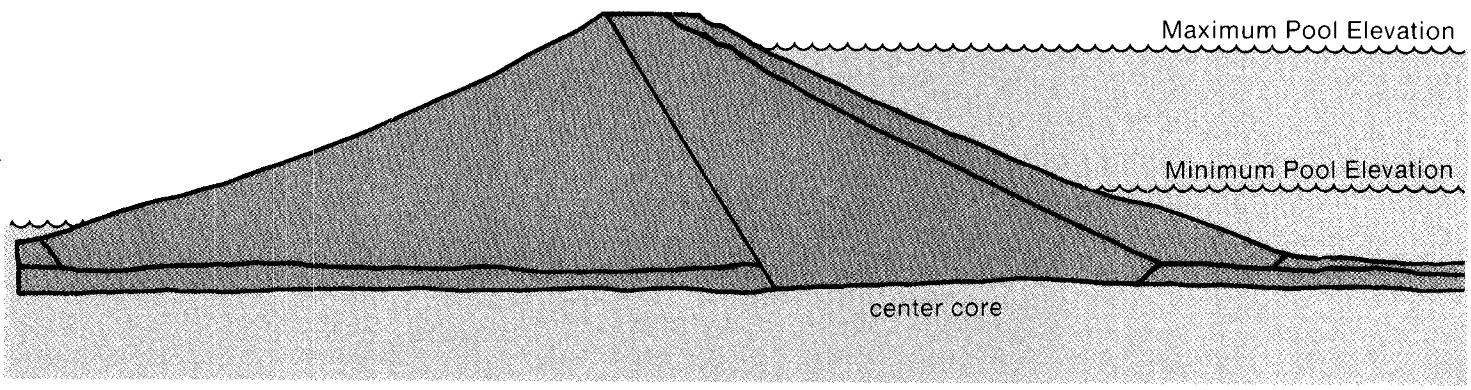
below: Power producing projects in the Willamette Valley are supplemented by a downstream reregulating storage dam to allow water release for power generation at any time without affecting downstream flows.



Concrete Dam



Earthfill Dam

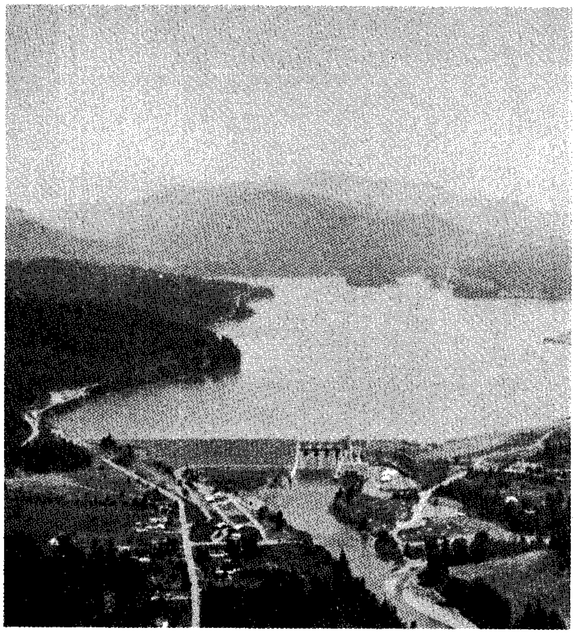


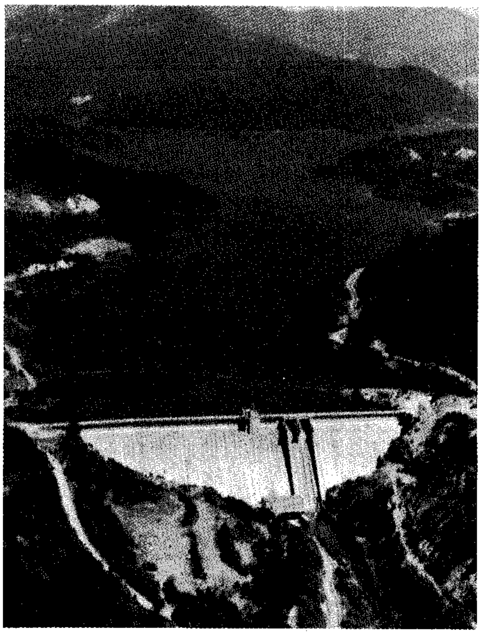
above, top: Section diagram of typical Willamette Valley concrete dam; above, bottom: Section diagram of typical earthfill dam construction.

would have overflowed the Portland seawall and covered the downtown core area from S. W. Ninth Avenue at Burnside Street in west Portland to S.E. Grand Avenue in east Portland, completely inundating the major commercial, financial, retail, industrial, and communication installations of the city. All underground public works, electric, and communication systems would have been out of service, creating a major health and safety hazard. Without the existing storage in the Willamette Basin and to a lesser extent the Columbia River, Portland would have experienced a disaster of historic proportions.

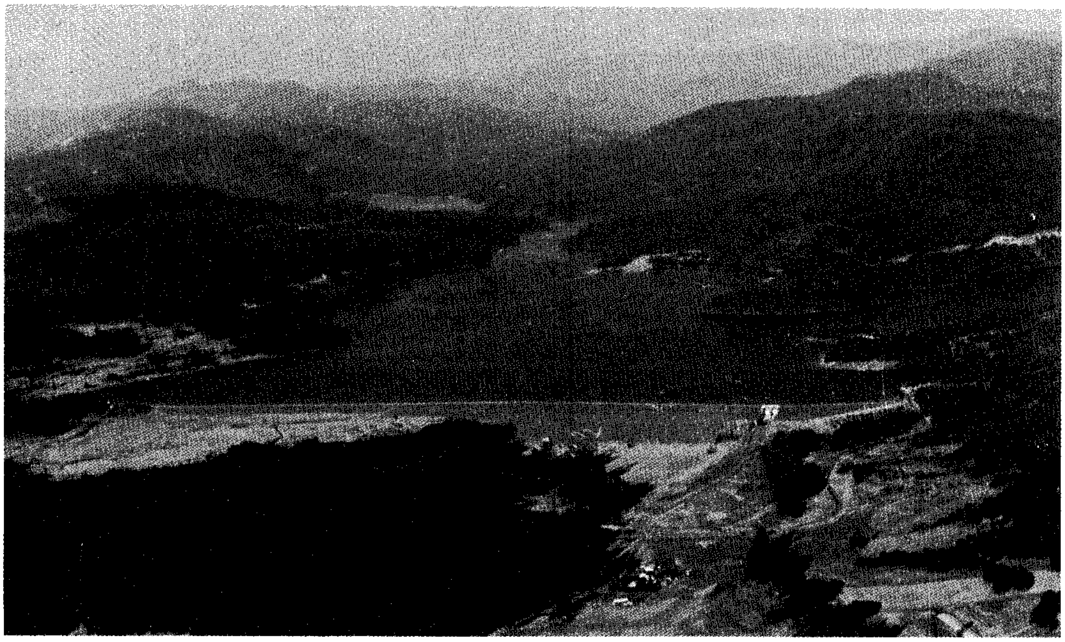
After the floods of December 1964 and January 1965, the Portland District completed additional multiple-purpose reservoir projects in the Willamette River Basin. The Corps located the largest of these projects, Green Peter Dam, on the Middle Santiam River about 5.5 miles above its confluence with the South Santiam River. The district designed and operated it as a unit with the Foster Dam 1.5 miles downstream from the confluence of the two rivers. The Foster reservoir provided reregulation of power releases from Green Peter as well as some flood control storage of its own. Construction started at the $84 million Green Peter and Foster projects in 1961. The devastating flood of December 1964 delayed progress for several months by destroying the two cofferdams and a bridge trestle. In addition, high water filled the powerhouse draft tube with rock and debris and ruined the pumping plant. Total damange caused by the flood reached $900,000.[8]

The 3,720-acre reservoir behind Green Peter provided about 430,000 acre-feet of storage and run-off control for about 280 square miles. The power plant has a capacity of 80,000 kilowatts. Foster, besides reregulating releases from Green Peter, provides 61,000





right: Foster Dam
far right: Green Peter Dam

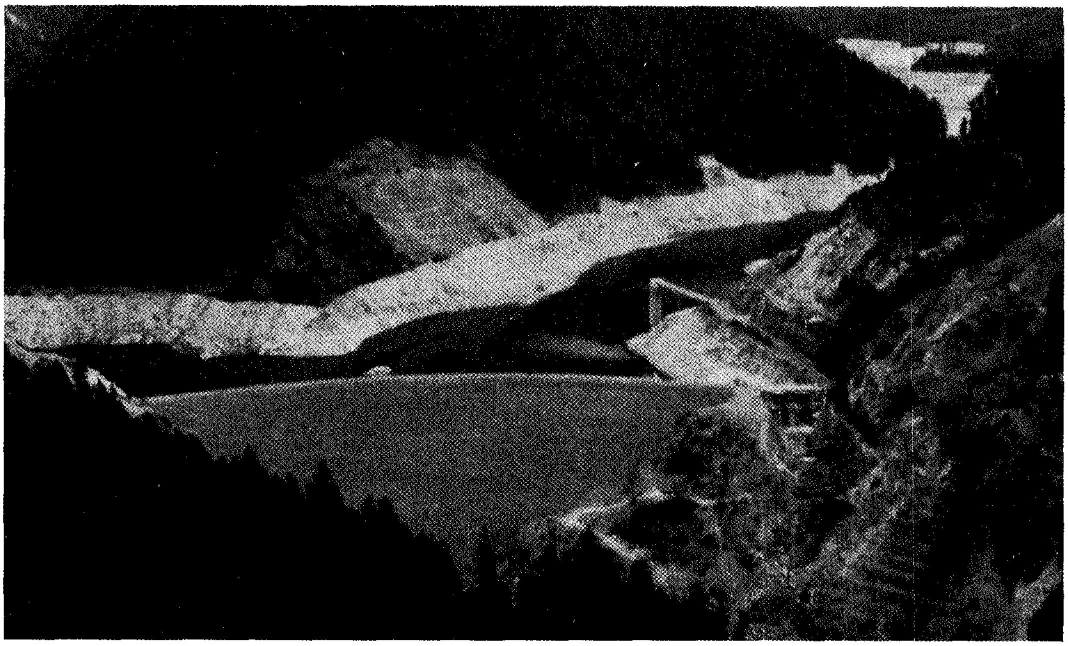


Fall Creek Dam

acre-feet of storage and includes one 20,000 kilowatt generating unit. Green Peter functions as a peaking operation, running about 40 percent of the time; while Foster generates power 80 percent of the time, smoothing out the fluctuations from its sister dam. Green Peter is a 360-foot-high concrete structure; Foster is a 126-foot-high rockfill embankment with an impervious core. The Portland District finished work on the dams in 1968.[9]

The Corps started Fall Creek Reservoir, authorized by the Flood Control Act of 1950, in 1963. Fall Creek served with Lookout Point and Hills Creek to control flood waters of the Middle Fork Willamette River. The engineers located the dam on Fall Creek about seven miles upstream from the confluence of Fall Creek and the Middle Fork Willamette River, 22 miles southeast of Eugene. The Portland District built Fall Creek Dam as a 195-foot-high, 5,100-foot-long rockfill and earth embankment structure with a gated spillway in its left abutment and outlet works in the right abutment. The 880-acre reservoir provided 125,000 acre-feet of storage and controlled run-off from about 184 square miles. Reservoir storage at this $22 million project began in October 1965.[10]

Blue River Dam, started in May 1963, comprised the third multiple-purpose project completed by the Portland District since the floods of 1964-65. Like Cougar Dam, Blue River functioned as one of three tributary dams selected in place of the Quartz Creek project. Built on the Blue River, a stream feeding the McKenzie River, the enbankment dam reached a height of 320 feet, with two gates and outlet works on the left abutment. The reservoir covered 975 acres and provided 89,000 acre-feet of storage, controlling runoff from 88 square miles. Reservoir storage went into operation at the $32 million Blue River dam in October 1968, and the contractors completed the project the following year.[11]



Blue River Dam

The Flood Control Act of 1950 also authorized Holley Dam and Reservoir on the Calapooia River. In addition to Holley Dam, the act provided for two separate, but related channel improvements on the downstream reaches of the river. The project design required the channel alterations to permit evacuation of Holley Lake following floods. Lacking the required local cooperation, the Portland District could not construct the channel improvements, which in turn forced discontinuance of the entire project in 1958. The district undertook a review study of the Calapooia in 1962 and later incorporated it into the Willamette River Basin Comprehensive Study. The reevaluation found the Holley Dam project not economically feasible.[12]

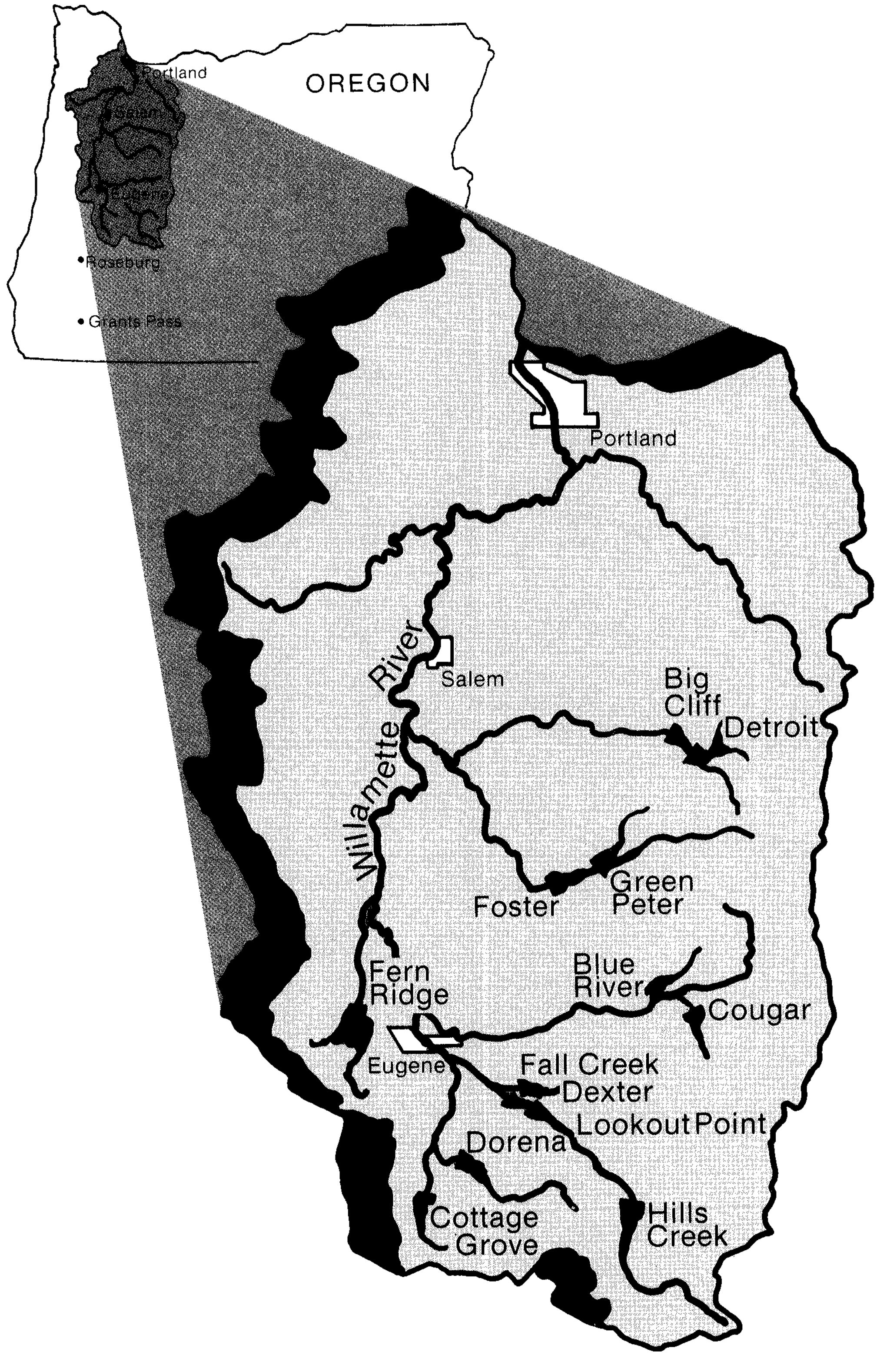
Three other Willamette Basin projects, recommended by the Portland District and authorized by the Flood Control Act of 1962, remain unbuilt. They include a dam on Gate Creek, a tributary of the McKenzie River 27 miles east of Eugene; Cascadia Dam on the South Santiam River; and Strube Reregulating Dam downstream from Cougar Dam on the South Fork McKenzie River. While Gate Creek and Cascadia Dams would provide 215,000 acre-feet of flood-control storage and other multiple-purpose attributes, current costs outweigh the benefits. Strube Dam would permit Cougar powerhouse to operate as a peaking plant, adding 35,000 kilowatts to the present production of 25,000 kilowatts. The district completed preconstruction planning for the project, but Congress has not yet funded it.[13]

Willamette Basin Planning

Although the Corps had carried out water resource development in the Willamette Basin for almost 50 years, the need for continued planning remained. Demographers estimated that population in the Willamette Valley would triple between the 1960s and 2020. Such growth will increase pressure on the available water and land resources. In response to this need, the Corps and 35 federal and state agencies cooperated in a multiagency study to establish a plan for future water resources development in the Willamette Basin. The plan, completed in 1969, identified short-term programs needed for the 1970s and long-range projects to meet requirements through 2020. It also identified areas needing additional studies. While still emphasizing structural solutions, the report recognized the necessity for nonstructural approaches to future development. It recommended management of more than 1,250 miles of basin streams to protect their free-flowing river qualities. Implementation of all plan elements involved a total investment of $5.1 billion by 2020. This expense coupled with serious questions about the environment impact of much of the plan has stalled it.[14]

Since the first plan for the comprehensive development of the water resources of the Willamette River Basin in 1938, the Corps of Engineers has changed the Willamette River from an uncontrolled threat to human welfare to an increasingly valuable asset. A series of dam and reservoir projects, built or authorized, provided about two million acre-feet of usable storage, with total storage about 2.8 million acre-feet. The Willamette's average annual runoff totals about 24 million acre-feet. With all authorized projects completed, about 40 percent more usable storage would exist than was available during the destructive flood of December 1964. Moreover, the many miles of levee and channel improvements also have created greater flood protection.

These reservoir projects yield many important benefits in addition to flood control. The Federal Columbia River Power System receives power from the dams in the Willamette



Map of Willamette River Basin showing location of reservoir projects.

Valley. Navigation, fishlife, and pollution abatement benefit from storage releases during low-flow summer periods. Water from these reservoirs irrigates farmland in the Willamette Valley. The basin's 13 completed multiple-purpose projects have greatly enhanced the livability of the region. In addition, three single-purpose flood control projects have been constructed on the Willamette and its tributaries under the flood control acts of 1936, 1938, and 1950. These projects, 92 percent complete, emphasize bank protection and channel improvements at 219 locations.[15]

The flood control and other multiple-purpose benefits have had some undesirable side-effects. Reservoir construction and operation has altered the environment of the Willamette Valley. Some lament the inundation of thousands of acres of timber and crop land and the conversion of scenic river valleys to reservoir shoreline or bottom. The projects have disrupted riparian wildlife habitat and destroyed the spawning and rearing areas for anadromous fish. Finally, raising and lowering reservoir pools has resulted in shoreline erosion and the destruction of an unknown number of prehistoric aboriginal sites. Water resource development involves a continuing choice among a complex variety of social, economic, and environmental goals.[16]

The completed and authorized Corps' Willamette Basin storage projects have the capability of controlling most flood flows within streambank levels. The Portland District designed the reservoirs to afford damsite control of 100-year frequency floods. However, complete flood control is unobtainable by storage alone because not enough storage sites exist. Levees and channel improvements also have inherent financial and environmental limits. In the future, nonstructural means will be needed to accomplish further flood damage reduction. Those measures include zoning and management to restrict urban, industrial, and agricultural expansion into the flood plain. As the Pacific Northwest River Basins Commission noted in a 1972 review of the Willamette Basin Comprehensive Plan, "probably one of the greatest problems currently facing the Willamette Basin is a need for more detailed land-use planning. . . . Through well planned Basin development and resource protection, the environment can be preserved and enhanced."[17]

Table II
U.S. Army Corps of Engineers
Willamette River Basin Reservoir Projects

Reservoir	Stream	River Mile [1]	Area Controlled Sq. Mi.	Area Controlled Percent [2]	Area Normal Pool (surface acres)	Storage Capacity (acre-feet) Flood Control	Storage Capacity (acre-feet) Total	Share of Construction Cost Allocated to Flood Control (percent)	Placed in Service for Flood Control (year)
Existing Projects									
Fern Ridge	**Long Tom R.**	**25.7**	**175**	**2.5**	**10,400**	**110,000**	**117,000**	**43**	**1941**
Cottage Grove	**Coast Fork Will. R.**	**29.7**	**104**	**0.9**	**1,158**	**30,000**	**33,000**	**49**	**1942**
Dorena	**Row River**	**7.6**	**265**	**2.4**	**1,840**	**70,500**	**77,500**	**57**	**1949**
Detroit	**N. Santiam R.**	**49.2**	**438**	**4.0**	**3,580**	**300,000**	**455,000**	**32**	**1953**
Big Cliff (reregulating)					**100**	**---**	**5,900**		**--**
Lookout Point	**Mid. Fk. Will. R.**	**19.9**	**991**	**8.8**	**4,360**	**337,000**	**456,000**	**55**	**1953**
Dexter (reregulating)					**1,025**	**---**	**27,500**		**--**
Hills Creek	**Mid. Fk. Will. R.**	**45.5**	**389**	**4/**	**2,735**	**200,000**	**356,000**	**54**	**1961**
Cougar	**S. Fk. McKenzie R.**	**4.5**	**208**	**1.9**	**1,280**	**155,000**	**219,000**	**63**	**1963**
Fall Creek	**Fall Creek**	**7.2**	**184**	**1.6**	**1,880**	**115,000**	**125,000**	**63**	**1965**
Green Peter	**Mid. Santiam R.**	**5.7**	**277**	**5/**	**3,720**	**270,000**	**430,000**	**51**	**1966**
Foster	**S. Santiam R.**	**37.7**	**494**	**4.4**	**1,220**	**30,000**	**61,000**	**---**	**1967**
Blue River	**Blue River**	**1.7**	**88**	**0.8**	**975**	**85,000**	**89,000**	**70**	**1968**
	Subtotal - Existing Projects					**1,702,500**	**2,451,190**		
Authorized Projects									
Holley 3/	**Calapooia R.**	**45.5**	**99**	**0.9**	**2,120**	**90,000**	**3/**	**3/**	
Cascadia	**S. Santiam R.**	**48.0**	**179**	**5/**	**1,700**	**145,000**	**160,000**	**71**	
Gate Creek	**Gate Creek**	**0.4**	**50**	**0.4**	**605**	**50,000**	**55,000**	**61**	
	Subtotal - Authorized Projects					**285,000**	**317,900**		
TOTAL			**3,196**	**28.6**		**1,986,760**	**2,769,090**		

1/ CBIAC river mileage, June 1963.
2/ Refers to percent of area drained by Willametter River (11,200 square miles).
3/ Project being restudied.
4/ Included in area above Lookout Point.
5/ Included in area above Foster.